

Claims

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[c1] A method for interfacing an electric motor to a controller using an electrical interface circuit, the interface circuit including a controller circuit and a motor control circuit, the controller circuit including a transmitter circuit and a receiver circuit, the motor control circuit including a transmitter circuit and a receiver circuit, and the interface circuit electrically coupled to the controller and the electric motor, said method comprising the steps of:
receiving a signal from the controller;
adjusting a level of the received signal to a desired level;
outputting the signal to control the electric motor;
receiving a signal from the electric motor; and
transmitting the received signal from the electric motor to the controller.

[c2] A method in accordance with Claim 1 wherein said step of receiving a signal comprises the step of the controller circuit receiving electrical signals from the controller.

[c3] A method in accordance with Claim 2 wherein said step of adjusting a level of the received signal comprises the step of converting an electrical signal from the controller to at least one of an infrared signal and an RF signal.

[c4] A method in accordance with Claim 1 wherein said step of adjusting a level of the received signal comprises the step of adjusting the signal level to communicate with an ECM motor.

[c5] A method in accordance with Claim 1 wherein said step of outputting the signal comprises the step of isolating a transmit signal to the electric motor.

[c6] A method in accordance with Claim 1 wherein said step of outputting the signal further comprises the step of interrogating the electric motor to acquire status and diagnostic information.

[c7] A method in accordance with Claim 6 wherein said step of interrogating the electric motor further comprises the step of acquiring at least one of an operating status, an operating speed, an operating torque, an input power

consumption, an under-speed condition, and a time of operation above a desired power level from the electric motor.

- [c8] A method in accordance with Claim 1 wherein said step of outputting the signal further comprises the step of commanding the electric motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.
- [c9] A method in accordance with Claim 1 wherein said step of outputting the signal comprises the step of controlling at least one of an operating profile, a delay profile, a slew rate, a speed limit, dynamic braking, and an inrush current of the electric motor.
- [c10] A method in accordance with Claim 1 wherein said step of receiving a signal comprises the step of isolating a receive signal from the electric motor.
- [c11] A method in accordance with Claim 1 wherein said step of transmitting the received signal comprises the step of converting an electrical signal from the electric motor to at least one of an infrared signal and an RF signal.
- [c12] An HVAC system comprising an electric motor, a controller, and an electrical interface, said electrical interface comprising a controller circuit and a motor control circuit, said controller circuit comprising a transmitter circuit and a receiver circuit, said motor control circuit comprising a transmitter circuit and a receiver circuit, said controller circuit electrically coupled to said motor circuit, said electrical interface electrically coupled to said controller and said electric motor.
- [c13] An HVAC system in accordance with Claim 12 wherein said electric motor configured as an ECM variable speed motor.
- [c14] An HVAC system in accordance with Claim 12 wherein said controller circuit electrically coupled to said motor control circuit using at least one of a serial four-wire communications cable, a wireless interface, and a digital wireless interface.

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[c15] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to adjust a voltage signal received from said controller to a desired level to communicate with said electric motor.

[c16] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to adjust a voltage signal to communicate with said electric motor, said electric motor configured as at least one of an ECM and an ECM variable speed motor.

[c17] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to adjust a voltage signal received from said electric motor to a desired level to communicate with said controller.

[c18] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to isolate a transmit signal to said electric motor and isolate a receive signal from said electric motor.

[c19] An HVAC system in accordance with Claim 12 wherein said motor control transmitter circuit comprises a first optocoupler.

[c20] An HVAC system in accordance with Claim 19 wherein said first optocoupler configured to provide noise immunity by isolating said motor control transmit circuit from said electric motor.

[c21] An HVAC system in accordance with Claim 12 wherein said motor control receiver circuit comprises a second optocoupler.

[c22] An HVAC system in accordance with Claim 21 wherein said second optocoupler configured to provide noise immunity by isolating said motor control receive circuit from said electric motor.

[c23] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to interrogate said electric motor to acquire status and diagnostic information.

[c24] An HVAC system in accordance with Claim 12 wherein said electrical

interface configured to command said electric motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.

[c25] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to interrogate said electric motor to acquire at least one of an operating status, an operating speed, an operating torque, an input power consumption, an under-speed condition, and a time of operation above a desired power level.

[c26] An HVAC system in accordance with Claim 12 wherein said electrical interface configured to transmit at least one of a voltage signal, an infrared signal, and a RF signal.

[c27] An HVAC system according to Claim 12 wherein said controller circuit configured to convert a voltage signal to at least one of an infrared signal and an RF signal.

[c28] An HVAC system according to Claim 12 wherein said motor control circuit configured for bi-directional communication with said controller circuit using at least one of a voltage signal, an infrared signal, and a RF signal.

[c29] An HVAC system according to Claim 12 wherein said controller circuit configured for bi-directional communication with said motor control circuit using at least one of a voltage signal, an infrared signal, and a RF signal.

[c30] An HVAC system according to Claim 12 wherein said controller circuit configured to convert at least one of an infrared signal and an RF signal to a voltage signal.

[c31]

An electrical interface circuit comprising a controller circuit electrically coupled to a motor control circuit, said controller circuit comprising a transmitter circuit and a receiver circuit, said motor control circuit comprising a transmitter circuit and a receiver circuit, said interface circuit electrically connected to a controller and electrically connected to an electric

motor.

[c32] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to adjust a voltage signal received from said controller to a desired level to communicate with said electric motor.

[c33] An electrical interface in accordance with Claim 32 wherein said electrical interface configured to adjust the voltage level to communicate with said electric motor, said electric motor configured as at least one of an ECM and an ECM variable speed motor.

[c34] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to adjust a voltage signal received from said electric motor to a desired level to communicate with said controller.

[c35] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to isolate a transmit signal to said electric motor and isolate a receive signal from said electric motor.

[c36] An electrical interface in accordance with Claim 31 wherein said motor transmit control circuit further comprises a first optocoupler.

[c37] An electrical interface in accordance with Claim 36 wherein said first optocoupler configured to provide noise immunity by isolating said motor transmit circuit from said electric motor.

[c38] An electrical interface in accordance with Claim 31 wherein said motor control receiver circuit further comprises a second optocoupler.

[c39] An electrical interface in accordance with Claim 38 wherein said second optocoupler configured to provide noise immunity by isolating said motor control receiver circuit from said electric motor.

[c40] An electrical interface according to Claim 31 wherein said motor control circuit electrically connected to said controller circuit using at least one of a serial four-wire communications cable, a wireless interface, and a digital

wireless interface.

- [c41] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to interrogate said electric motor to acquire status and diagnostic information.
- [c42] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to command said electric motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.
- [c43] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to interrogate said electric motor to acquire at least one of an operating status, an operating speed, an operating torque, an input power consumption, an under-speed condition, and a time of operation above a desired power level.
- [c44] An electrical interface in accordance with Claim 31 wherein said electrical interface configured to control at least an operating profile, a delay profile, a slew rate, a speed limit, dynamic braking, and an inrush current of said electric motor.
- [c45] An electrical interface according to Claim 31 wherein said controller circuit configured to convert a voltage signal to at least one of an infrared signal and an RF signal.
- [c46] An electrical interface according to Claim 31 wherein said motor control circuit configured for bi-directional communication with said controller circuit using at least one of a voltage signal, an infrared signal, and a RF signal.
- [c47] An electrical interface according to Claim 31 wherein said controller circuit configured for bi-directional communication with said motor control circuit using at least one of a voltage signal, an infrared signal, and a RF signal.
- [c48] An electrical interface according to Claim 31 wherein said controller circuit

configured to convert at least one of an infrared signal and an RF signal to a voltage signal.

- [c49] An HVAC system comprising an electronically commutated motor, a controller, a serial four-wire communications cable, and an electrical interface, said electrical interface comprising a controller circuit and a motor control circuit, said controller circuit comprising a transmitter circuit and a receiver circuit, said motor control circuit comprising a transmitter circuit including a first optocoupler and a receiver circuit including a second optocoupler, said controller circuit electrically connected to said motor circuit by said serial four-wire communications cable, said electrical interface electrically coupled to said controller and said electronically commutated motor and said electrical interface configured to interrogate said electronically commutated motor to acquire status and diagnostic information.
- [c50] An HVAC system in accordance with Claim 49 wherein said first and second optocouplers configured to isolate signals between said motor control circuit and said electronically commutated motor.
- [c51] An HVAC system in accordance with Claim 49 wherein said electrical interface configured to command said electronically commutated motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.
- [c52] An HVAC system in accordance with Claim 49 wherein said electrical interface configured to interrogate said electronically commutated motor to acquire at least one of an operating status, an operating speed, an operating torque, an input power consumption, an under-speed condition, and a time of operation above a desired power level.
- [c53] An HVAC system in accordance with Claim 49 wherein said electrical interface configured to control at least an operating profile, a delay profile, a slew rate, a speed limit, dynamic braking, and an inrush current of said

electronically commutated motor.

[c54]

An electrical interface circuit for a HVAC system including an electronically commutated motor, said electrical interface comprising a controller circuit electrically connected to a motor control circuit using a serial four-wire communications cable, said controller circuit comprising a transmitter circuit and a receiver circuit, said motor control circuit comprising a transmitter circuit including a first optocoupler and a receiver circuit including a second optocoupler, said interface circuit electrically connected to a controller and electrically connected to said electronically commutated motor, wherein said first and second optocouplers configured to isolate signals between said motor control circuit and said electronically commutated motor and said electrical interface configured to interrogate said electronically commutated motor to acquire status and diagnostic information.

[c55]

An electrical interface circuit in accordance with Claim 54 wherein said electrical interface configured to command said electronically commutated motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.

[c56]

An electrical interface circuit in accordance with Claim 54 wherein said electrical interface configured to interrogate said electronically commutated motor to acquire at least one of an operating status, an operating speed, an operating torque, an input power consumption, an under-speed condition, and a time of operation above a desired power level.

[c57]

An electrical interface circuit accordance with Claim 54 wherein said electrical interface configured to control at least an operating profile, a delay profile, a slew rate, a speed limit, dynamic braking, and an inrush current of said electronically commutated motor.

[c58]

An electrical interface circuit for a HVAC system including an electronically commutated motor, said electrical interface comprising a controller circuit electrically connected to a motor control circuit using a digital wireless

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64

interface, said controller circuit comprising a transmitter circuit and a receiver circuit, said motor control circuit comprising a transmitter circuit including a first optocoupler and a receiver circuit including a second optocoupler, said interface circuit electrically connected to a controller and electrically connected to said electronically commutated motor, wherein said first and second optocouplers configured to isolate signals between said motor control circuit and said electronically commutated motor and said electrical interface configured to interrogate said electronically commutated motor to acquire status and diagnostic information.

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- [c59] An electrical interface circuit according to Claim 58 wherein said motor control circuit configured for bi-directional communication with said controller circuit using at least one of a voltage signal, an infrared signal, and a RF signal.
- [c60] An electrical interface circuit according to Claim 58 wherein said controller circuit configured for bi-directional communication with said motor control circuit using at least one of a voltage signal, an infrared signal, and a RF signal.
- [c61] An electrical interface circuit according to Claim 58 wherein said controller circuit configured to convert a voltage signal to at least one of an infrared signal and an RF signal.
- [c62] An electrical interface circuit according to Claim 58 wherein said controller circuit configured to convert at least one of an infrared signal and an RF signal to a voltage signal.
- [c63] An electrical interface circuit in accordance with Claim 58 wherein said electrical interface configured to command said electronically commutated motor to operate as at least one of a constant torque motor, a constant airflow motor, and a constant speed motor.
- [c64] An electrical interface circuit in accordance with Claim 58 wherein said electrical interface configured to interrogate said electronically commutated

